DOCUMENT RESUME

ED 274 689 TM 860 557

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TITLE Perceptions and Preferences of a Learning Environment: Multidimensional Scaling Approaches.
PUB DATE Apr 86
NOTE 59p.; Paper presented at the Annual Meeting of the American Educational Research Association (67th, San Francisco, CA, April 16-20, 1986).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Attitude Measures; *Beliefs; *Classroom Environment; *Classroom Research; Cognitive Structures; Interviews; Kindergarten; *Multidimensional Scaling; Parent Attitudes; Preschool Education; Research Methodology; *Student Attitudes; Teacher Attitudes; Teacher Student Relationship
IDENTIFIERS Personal Construct Theory

ABSTRACT

Thirty-two kindergarten children, nine parents, and two teachers participated in a study of classroom learning environments. Participants included lower and middle income White and Hispanic families; the children were enrolled in three schools in the southwestern United States. Both interviews and pictures of classroom learning events were used to elicit beliefs about learning in school. A learning events taxonomy was developed and became the basis for two sets of pictorial stimuli--one used to elicit personal constructs and the other for preference rank order. Participants were asked to sort the drawings, describe the groups, discuss classroom learning descriptors, and rank favorite learning activities. Three analyses of the data were performed; the first two analyses used multidimensional scaling models: INDSCAL (Individual Differences Scaling model); and EUCLID; both are available in the Alternating Least Scales (ALSCAL). The third analysis used interrater reliability. INDSCAL revealed two dimensions, participant configuration (student participation) and learning activities structured by teachers (work) versus activities engaged in by children (play). The EUCLID model was used to analyze the descriptions of learning environments; a degenerate solution was obtained. Kendall's tau, which was used to analyze the preference rank ordering, indicated no predictable differences in pattern between parents and children. However, the two teachers had very different tau values from each other. Several tables and many figures are provided, including illustrations used in the research. A six-page reference list is offered. (GDC)

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Perceptions and Preferences of a Learning Environment: Multidimensional Scaling Approaches

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Paper presented at the annual meeting of the American Educational Research Association

San Francisco

1986

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Perceptions and Preferences of a Learning Environment: Multidimensional Scaling Approaches

Investing in our Children, a recent report submitted by the Committee for Economic Development (1985), advocates a renewed emphasis on preschool education to promote long-term educational gains and future economic stability. This stance is particularly timely given the changing demographic characteristics of the preschool population. Currently, over twenty six percent of the preschool population in the United States lives in poverty and many of these children in poverty are also members of ethnic minority groups (Udsen, 1984). Indeed, demographers indicate that by the end of the decade over fifty percent of the public school population will be composed of minority students, many of whom will be poor (Udsen, 1984; U.S. & News & World Report, 1983). This demographic shift is alarming, in that, poor and minority children consistently experience severe underachievement in school and are at-risk for school failure (Coleman, Campbell, Hobson, Partland, Mood, Weinfeld, York, 1966; McLean, 1984). The persistence of school failure for this emerging student majority has serious implications for teaching and learning in schools and society at large.

This is, of course, a multi-dimensional problem with no unitary set of causes or solutions. However, collected research suggests that what participants believe about learning affects what is learned in the classroom (Brice-Heath 1982, 1983; Labov,1972; Byers and Byers, 1971; Ogbu, 1974; and Rist, 1970), and the degree of a student's engagement during classroom learning tasks is highly related to the way in which he or she construes classroom learning events (Salmom and Claire,1984). Beliefs about learning impact school achievement (Ogbu, 1974), but, perhaps even more critically,

differences between teacher and student beliefs place academic learning at risk (Brice-Heath, 1982; Labov, 1974; McDermott, 1974).

One hypothesis which follows from this research is that when teachers and students construe classroom learning events differently miscommunication results. Thus, the learning itself may be lost. This phenomenon of miscommunication among classroom participants may be revealed through personal construct theory and its elicitation procedures. Personal construct theory posits that people formulate hypotheses, make observations, and test and refine their hypotheses to construe a theory which describes their world (Kelly, 1955). These personal construct systems, which evolve from this hypothesis testing, are then altered or sustained through participation in the setting (Kelly, 1955; Nystedt, 1982; Salmon, 1979). In the context of the classroom environment, Kelly's (1955) postulates suggest that children and teachers have constructs about a learning environment which are modified through their interactions during classroom learning events.

To learn how the many facets of a classroom work together for the various participants, personal construct theory suggests that the environment must be approached from different vantage points. To uncover the personal constructs of the classroom participants requires presenting the different dimensions of the classroom in the form of learning events. Meeting these requirements will allow eliciting both the individual's beliefs about learning and comparing the belief sets of participants. Adapting personal construct theory to the study of participant beliefs about classroom learning events argues for an iterative, multi-operational research approach in this study.

It is clear from the foregoing that methodologies are needed that tap the underlying dimensions which structure participant interactions in the environment. Personal construct theory provides the parameters for the study and allows the flexibility for an iterative process in developing effective instruments and procedures to elicit the constructs of both adults and children. The focus of this paper addresses two aspects of this problem: the development of the stimuli of classroom learning events and the interview procedures to elicit the personal constructs of kindergarten children, their parents and teachers; and the viability of multidimensional scaling procedures in uncovering belief patterns of the participants. The potential implications of both the procedures and analyses are then considered in understanding the complexity of beliefs about learning environments.

The complex problem -- a majority of the school population educationally at-risk -- led to the hypothesis that the interaction of the participants' personal constructs about learning impact academic achievement. The divergent research sources used to generate the questions addressed in this research require a cursory overview of related socio-cultural and personal construct research and a description of non-verbal procedures possible for use in multidimensional scaling algorithms and pairwise comparison procedures. This background information provides the raison d'etre for the way in which the beliefs of the participants in this study were assessed. The methodology section which follows this background review includes: 1) a description of the participants and the setting; 2) a discussion of the iterative process used to develop the stimuli; 3) a presentation of the interview tasks; and 4) a discussion of the multidimensional scaling solutions. The paper concludes with a discussion of

the viability of combining personal construct procedures with multidimensional scaling.

Related Research

The study of participant beliefs about school learning is, in reality, uncovering the theory which kindergarten children, parents, and their teachers use to construe learning events in school. In establishing a case for the viability of the study of the beliefs which young children have regarding learning in school, several divergent themes are considered. First, socio-cultural research suggests that belief differences between children and teachers contribute to the educational risk factor. Second, research regarding the methods used to elicit personal constructs indicates that pictorial stimuli are effective to elicit the personal constructs of children and to compare their beliefs with those of parents and teachers. Finally, research surrounding nonverbal choice behavior supports the value of pictorial stimuli to obtain psychological preferences. The related research presented underscores the need to incorporate several strategies to learn about the beliefs which participants have about school learning.

Socio-Cultural Research

Research that has adopted an interpretive paradigm (Erickson, 1985) in studying the schooling process indicates that belief systems about how one learns impact school learning. Shirley Brice-Heath's (1982; 1983) recent work with families and schools offers insight into the way in which beliefs influence learning in school. In a five year research project with a poor-minority and middle class non-minority families, she discovered that families provided learning opportunities at home in very different ways. The middle class parents taught their children through question and answer sessions, while the poor families provided information to their children

through storytelling and their children responded in kind. In school, the classroom learning events followed the middle-class family learning paradigm of questioning and answering, which, Brice-Heath hypothesized, put the minority child at risk for school failure. Her subsequent research in the classroom supported this notion and also demonstrated that when the teacher becomes aware of these belief differences and provides alternative learning events, minority children were successful in school. Her work is a clear demonstration of not only the influence of beliefs on school learning, but the change that occurs when belief differences are brought to an awareness level (Hall, 1966).

Ogbu's (1974) research highlights the interaction of parent, student, and teacher beliefs on school learning. In a study of the triadic interactions of middle class non-minority and poor minority parent, student, and teacher beliefs about school learning, Ogbu uncovered an interesting artifact. All parents taught their children that a good education was necessary for later success; however, poor, minority parents gave their children an additional message. A good education did not guarantee later life success as the social construction of the world constrained later opportuniites for success. The students interpreted this double *entendre*, by accomplishing only the minimal requirements in school. The teachers reinforced both the student and the parent beliefs by overtly stating that these students did as well as could be expected. The limited school success of these students did not augur well for more than minimal occupations later in life.

Teacher beliefs about student capabilities can be deleterious from the beginning of a child's school career. Rist (1970) found that the beliefs which kindergarten teachers had about students affected the learning opportunities afforded to students. In an all-Black kindergarten classroom, the students

who had the most pronounced dialect and were the least well-dressed, received the fewest learning response opportunities from their Black teacher. The teacher considered these students as marginal and did not believe that they could learn academically. They were placed in the lowest track in first grade, and by the end of second grade these same students were performing at an academically marginal level . The beleifs which the kindergarten teacher had about these students were actualized.

Byers and Byers (1971) studied the influence of teacher beliefs at a molecular level. In a thirty-three minute videotaped lesson of the preschool teacher with four children -- two Black and two White, they discovered a lack of syncopation in the interactions between a preschool teacher and a Black preschool child which was not evident in the teacher's interaction with a White child in the group. The researchers found that fluid nonverbal interactions and frequent interactions occurred between the teacher and the non-minority child. However, the minority child was forty percent less successful in establishing non-verbal contacts with the teacher. Not only was the teacher unaware of this dynamic, but several viewings of the videotape were required before the researchers themselves saw the differences in the interactions.

Labov's research (1972) indicates that when this lack of syncopation and congruity among participants continues, students disregard the teacher as a source of information and look to their peer group for approval and information. A sociolinguistic analysis of low socioeconomic black adolescent language revealed that these students used circumscribed and limited syntactical structures in the classroom. However, in neighborhood settings, these same students used sophisticated and complex language structures. The classroom was a powerful treatment for these students.

Personal Construct Psychology

Personal construct elicitation, a methodology derived from the theory which George Kelly (1955) developed, is primarily a clinical procedure used to learn how a person comes to understand and to perceive his or her world. As a clinical procedure, personal construct elicitation has been used effectively to learn what young childen think (Salmon, 1979). This clinical aspect has made personal construct psychology the topic of many methodolgical and data analyses studies (Fransella & Bannister, 1986; Slater, 1979); consequently, experimenting with various approaches in both eliciting constructs and analyzing this interview data has considerable empirical support.

Salmon (1979) provided some of the most important work in using personal construct theory to discover what it is that young children think, believe, and construe. In personal construct interviews with young children, she presents them with figures of people representing their parents, teachers, siblings, and friends, and then uses a clinical approach in which children talk about these figures. For example, a child selects a figure of a woman, calls her Mother, and says, "She helps me." The clinician then asks the child to select other persons from the remaining figures who help the child. In this way the clinician leans about the child's construct for help. When the child has completed the personal construct interview tasks, the clinician, through evaluating the constructs of the child, learns what the child thinks about family relationships and the relative importance of others in his or her life. Salmon (1979) contends that personal construct elicitation is most amenable to understand the way young children construe their environments.

Researchers have used variants of these personal construct elicitation approaches successfully with children and mentally disabled persons to learn about a variety of aspects of their lives. For example, Baillie-Groham (1975) used mime as a way to learn what deaf children thought about learning in school and Barton (1976) showed mentally retarded persons stand-up cut-outs to learn about the constructs they had about important persons in their lives. Bannister (cited in Fransella & Bannister, 1977), to learn more about how children with emotional disorders perceived learning tasks, showed them a series of photographs of a boy completing a puzzle. Personal construct work with high schools students utilized pictures of scenes in the classroom and interviews with students to learn what they thought about collaborative learning, and subsequent observations in the classroom indicated that students acted on their beliefs or personal constructs (Salmon & Claire, 1984). Salmon's (1979) application of personal construct elicitation procedures to work with children and in school settings is appropos to acquire more specific information about how children construct their personal theories about classroom learning events.

Although such research strategies are feasible in studying the beliefs which kindergarten children and adults have about classroom learning events, there are some problems with the analyses and interpretation of the personal constructs which are elicited (Fransella & Bannister, 1979). For example, both Slater's (1979) principal components analysis procedure for analyzing personal construct interview data and the standard repertory grid technique (Fransella & Bannister, 1979) require rank ordering of all elicited constructs with the stimuli -- a cognitively complex task for young children. Eliciting the individual perceptions of young children and their parents and teachers and then comparing the belief patterns of these groups requires

adjunct procedures to the typical analyses available to evaluate personal construct elicitation.

Non-Verbal Preferences

Beliefs about environments are based in part on the way an individual perceives the features or dimensions of objects or events in the environment. The perception of environmental features, which includes organizing and categorizing the similar or dissimilar dimensions of stimuli, is affected by many factors (Bruner, 1957). However, it is generally accepted that both the objects or events and the individual influence the way a person selects, organizes, and understands information from an environmental setting (Postman, 1951; Taguiri, 1969; Tajfel, 1969). A person's social and cultural background and their experience and familiarity with the objects in the environment affect the way they organize and categorize objects and events. Furthermore, the less familiar a person is with given stimuli, the more likely he or she is to consider the stimuli as similar (Berkowitz, 1975). In addition, a valid psychological response to a set of objects or stimuli is non-verbal, that is, individuals attend to the dimensions of environmental objects or stimuli and express preferences through non-verbal choice behavior (Alpert, et al., 1977; Green and Wind, 1973). This information has import in considering the way in which young children construe classroom learning events. Young children respond to the various dimensions of a classroom learning environment without necessarily articulating their preferences. Methods to understand the non-verbal choice behavior of children provide a way to understand their perceptions of a learning environment.

Multidimensional scaling and preference rank ordering allow respondents to select objects or stimuli by responding to the dimensions

which have saliency for them. Multidimensional scaling (MDS) is designed to uncover the underlying structure, or psychological map, of a set of stimuli or the basis of perceived similarity among them. MDS does not impose prior constraints on the respondents but it does uncover the number of dimensions that underlie the perception of a set of stimuli (Shepherd, 1974). In essence then, MDS shows the pattern of the stimuli on the dimensions which are uncovered by the solution. Multidimensional scaling, an analysis procedure which has been used to interpret the personal construct elicitation data of adults (Brennan, 1983; Harman, 1975;), seems a likely alternative to other available procedures especially since grouping procedures are not verbally taxing to the respondent.

An ancilliary approach to the multidimensional scaling procedures in considering preferences which children have about a learning environment is the preference rank ordering of pictorial stimuli of classroom learning events. Rank ordering provides information about the way in which individuals place dimensions of objects and stimuli on a psychological continuum (Alpert, et al., 1979; Edwards, 1957; Shocker & Srinivasan, 1973). Selecting preferred pictures provides a more precise understanding of the nuances of learning events. The analysis of children's choices of pictorial stimuli which represent classroom learning events is a means to explore alternative interpretations regarding classroom learning environments for young children. The following research was an effort to learn about the constructions which kindergarten children had about classroom learning events.

Study Description

A kindergarten classroom is replete with a variety of activities, tasks, and materials which teachers and children use to create classroom learning

events. The learning events themselves are arrangements of participants in a variety of subsettings participating in activities in the classroom. Possibilities for these learning events might include a small group of five children sitting on the carpet with the teacher completing a math lesson on sets; a child dyad building with blocks in a learning center; or an individual child constructing patterns from logical blocks at a table. The range of possibilities suggests a complexity in the classroom learning environment which provides an array of learning choices to both the teacher and the children. We know little, however, about the choices of classroom learning events which children and teachers make nor do we know how their beliefs about school learning influence these very choices. In addition, there is scant information regarding the influence of teacher or parent beliefs about learning on those of children. Thus, the critical aspect of this study was the development of interview procedures and pictorial stimuli which had saliency for both child and adult participants, and adequately represented classroom learning events.

Participants

Thirty-two kindergarten children, nine parents, and two teachers volunteered to participate in the study. The children were from lower and middle income White and Hispanic families and they were enrolled in three racially integrated kindergarten classrooms three different schools in the southwestern United States. Eight children from the Northside and the Jones school were included in the study, and the remaining 16 children were enrolled in the Smith school. The 16 children enrolled in the Smith school kindergarten represented nine Hispanic and seven Anglo middle income families. The Northside kindergarten classroom represented an upper middle class economic group and three Hispanic, one Black, and four Anglo

children. The three Hispanic and five Anglo children from the Jones kindergarten were from lower working class economic groups.

The Jones school provided the information about parents and teachers. Nine parents whose children were enrolled in Jones kindergarten agreed to participate. Eight of these parents were mothers, with three of them heading single parent families with their kindergarten child as an only child. Both parents lived with the other five children and these children each had one to three siblings. Both the mother and the father of one of these five children participated in the study.

The Jones kindergarten classroom was a team taught classroom whereby the teachers shared instructional responsibilities for their two classes. These teachers, who were both Anglo, were veterns with more than ten years of teaching experience at the kindergarten level. Both teachers were middle income to upper middle income status.

Development of the Instruments

A major aspect of this study was the construction of pictures which were relevant for the respondents so that they evoked their beliefs about learning in school. There were two stages to this process: 1) developing a taxonomy of learning events which occurred in the classroom ; and 2) constructing pictorial stimuli of the learning events which were suitable for the personal constructs elicitation and pairwise comparison. Satisfying these requirements facilitated the development of interview procedures which were appropriate for the multidimensional scaling and rank ordering analyses.

The curriculum and organizational design of kindergarten classrooms in the geographic region included in this study are very similar. Conversations with curriculum specialists, school administrators, and

kindergarten teachers and observations in three kindergarten classrooms confirmed the commonalities in the classroom environments. Therefore, selecting a related public school kindergarten to develop the stimuli for the personal construct elicitation was feasible for the participants interviewed in this study. During the spring semester preceding the study, the picture stimuli used in the research were developed through observations in a apublic school kindergarten which paralleled the characteristics of the three kindergartens included in the study. The generalizability of these pictorial stimuli was ascertained through a pilot study conducted in the late Spring with 20 kindergarten children, eight teachers, and ten parents.

The teacher workplan has primacy in understanding the day-to-day workings in the classroom. The workplan was analyzed before the researcher entered the classroom setting. From this analysis details about the classroom were identified such as, time designated for tasks, the instructional curriculum, the curriculum materials available, the instructional groupings, and the classroom locations for instruction. The researcher then used the data from the teacher workplan analysis to guide photographing the classroom learning events.

The researcher subsequently spent a week in the classroom and photographed over 250 classroom learning events. For each learning event photographs were taken with a wide angle lens from the teacher's and children's vantage point in the classroom. The researcher then showed selected photos to the teachers and the children and asked them to describe the learning scenes. From the combined information of the conversations, photographs, and teacher workplan, a taxonomy of classroom learning events was compiled. Observations in the classroom corroborated the validity of the learning occurrences taxonomy.

These learning occurrences were categorized as: outdoor play, transition, large and small group instruction with the teacher, children working in dyads or alone on either teacher-assigned or self-selected tasks. Each learning occurrence was detailed further by the activity, classroom subsetting, participant configurations, and actions of the participants, and the learning tasks themselves were delineated into language, cognitive, and motor tasks. As an example, the scene of a large group instructional activity depicts all of the children sitting on the rug (subsetting) with the teacher sitting in a chair facing the group of children (participant configuration). The teacher is holding up (action) a number card (cognitive/language activity) and the children are raising their hands (action) to provide a response.

The learning events taxonomy became the basis for two sets of pictorial stimuli -- a personal construct elicitation set and a preference rank order set. The personal construct elicitation set of pictures was a stratified random sample of the photographs which represented the learning events which occurred each day in the classroom. The time allocated to various learning tasks was verified by the photographic evidence. Thus, the time designated to learning events by the teacher workplan became the criterion to stratify the photographs and to select a representative sample. The frequency of time spent on classroom learning events was used to form the stratified random sample. The photographs were then translated into ten 8 x 10 inch black and white pen and ink drawings. These artist's renderings were essential to preserve participant anonymity and to remove extraneous figure-ground detail from the pictorial representation of the classroom. Figure 1 contains reductions of the personal construct drawings.

Photographs representing the classroom learning occurrences for the preference rank order procedure were formed into a matrix of all possible

Figure 1

Personal Construct Elicitation Pictorial Stimuli

1

2

3

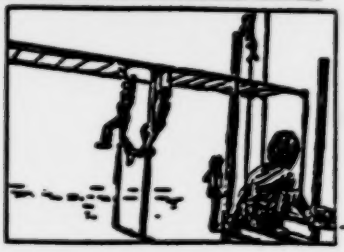
4

5

6

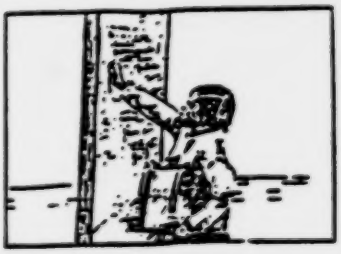
7

8



9

10



combinations of the classroom learning occurrences. An orthogonal array (Alpert, et al., 1977; Green, 1978) was used to delineate the dimensions or attributes of the classroom learning events. The attributes of the classroom learning events -- participant configuration, subsetting, and activity -- each had three levels (Table 1). When the three levels of each of the three attributes are multiplied (3 x 3 x 3), 27 possible combinations of classroom learning events result (Green & Wind, 1973). Using a Graeco-Latin square procedure to reduce the field of 27 possible combinations, a sample of nine classroom learning occurrences photographs were selected (Green & Rao, 1975; Hays, 1981).

The preference rank order set of pictures were also black and white pen and ink artsit's renderings. Gender, ethnic, and facial ambiguity of the children and teachers represented in the pictures were maintained to ensure that the participants would respond to dimensions or attributes of the pictorial stimuli. In addition, the teacher, individual child, and child dyad were constant. Figure 2 depicts the pictures used in the preference rank order procedure.

Supplied words which described classroom learning events and the personal construct pictorial stimuli were developed into a matrix so that respondents could rate each word with each picture. The matrix which resembled a game board was used to maintain child interest during the interview tasks. The supplied words were selected for the personal construct interviews conducted during the pilot study phase of the research project. From the taxonomy of the words and phrases which children used to describe the classroom learning events, three action and three judgment words most frequently used were selected for the picture/word matrix. Figure 3 illustrates the format of this matrix.

Table 1

Levels and Attributes of Classroom Learning Events

Participant Configuration	Subsetting	Activity
teacher with children	learning center	language
child dyads	rug	motor
individual child	table	cognitive

Figure 2

Preference Rank Order Pictorial Stimuli

1

2

3

4

5

6

7

8

9

Figure 3

Example of Rating Game Board for Supplied Words and Pictures

FUN	10	9	5.5	1
LEARNING	2	9	10	1
HARD	2	1	10	5.5
PLAYING				
BORING				
TEACHING				

Tasks to Elicit Perceptions of the Participants

The children, parents, and teachers all completed the same tasks with the pictorial stimuli. In an individual thirty to forty-five minute interview with the researcher, each respondent sorted the set of personal construct drawings, provided descriptions for their groupings, compared descriptors of classroom learning events with the personal construct pictures, and rank ordered the preference rank order pictorial stimuli. The children and teachers in the Jones School were interviewed during the first and the second semesters; whereas, the parents of the children enrolled in the Jones kindergarten were interviewed only during the Fall semester. The researcher interviewed the Jones school parents and the children in their homes, and the Jones kindergarten teachers were interviewed after the school day in their classroom. The children enrolled in the Northside and Smith schools were interviewed in a quiet area apart from their classrooms during the second semester.

Before each interview the researcher told the participant that she wanted to learn about kindergarten classrooms so she was talking to parents, teachers, and kindergarten children to discover what they thought about learning events in school. The researcher then explained that she would show them pictures of classroom learning events and ask them to group the pictures, describe their groups, and select their favorite learning activities. Slight adaptations in vocabulary and syntax were made for the directions given to the children.

The tasks to elicit the personal constructs required nonverbal sorting of the personal construct pictorial stimuli (Figure 1) and verbal descriptions of the resulting sorts. As a warm-up activity, the researcher showed the respondent the array of ten pictures and asked him or her to select pictures

one at a time and to describe each. The respondent was then asked to group the ten pictures so that each group was similar in some way. The only rule was that no picture could be in more than one group. Once the respondent had placed the pictures into groups, the researcher pointed out one group at a time and asked what was similar about the pictures in the group. Next the researcher asked the respondent which picture in the group most represented that particular group. Finally the researcher asked the respondent to select a picture which was different from the representative group picture. Typical examples of the groupings and descriptors of the groupings from a child, parent, and teacher interview were:

Child

The three outdoor pictures (Figure 1 pictures 3, 5, 8) with the group described as children playing was a frequent grouping for children. The picture most representative of this group is the scene in which children are playing on the jungle gym (8) and a picture very different from this is the large group teacher instructional activity (9) with the descriptor working.

Parent

The outdoor picture of the children in a line with the teacher and the large group teacher instructional activity (Figure 1 pictures 3, 9) described as structured learning, was a frequent parent grouping. The large group instructional activity (9) is most representative of this group, while, the outdoor scene with the children talking (5), described as carefree and fun, is seen as the opposite of the instructional activity.

Teacher

> An example of a teacher sort of the pictures which was described as the teacher interacting with the children were the teacher instructional tasks (Figure 1 pictures 1,9) with the small group instruction (1) as most representive because the teacher interacts with individual children more frequently. The outdoor scene on the jungle gym (8), having fun with others, was viewed as the opposite of this group.

These personal constructs were formed into a typology which provided a means to interpret the multidimensional scaling solution (Figure 4).

Respondents were then presented with the set of nine preference rank order pictorial stimuli and asked to rank order the pictures. They were first asked to sort the nine pictures into three groups. The children were asked to select three pictures which were their favorite activities, then three activities they would not like to do. The researcher then asked the child if the remaining three pictures were, "just okay-- not your favorite but you wouldn't mind doing these things." The adults also sorted the pictures into three groups, but were asked to select pictures according to learning activities which they most and least preferred for kindergarten children. They were asked if they viewed the remaining three pictures as neutral. Each respondent then rank ordered the pictures in each of the three sets in preference order. After completing the rank ordering task, the respondent was asked to describe the characterisitics of the three groups of pictures.

The last interview task required respondents to rate the supplied words which described classroom learning events with personal construct picture stimuli. Rating of 10 and 9 were given to the pictures which were most like the word and rating of 1 and 2 were assigned to the pictures most unlike the word. Since the same procedures were used with adults and

Figure 4

Illustrative Examples of Typology of Personal Constructs

	CHILDREN	PARENTS	TEACHERS
Transition Activity Pictures 3, 10	-playground -playing	-teaching/learning -more supervised	-listening -language
Teacher Instruction Pictures 1, 9	-raising hands -teaching	-group instruction -teaching/learning	-teacher giving information
Child-Dyads Pictures 2, 6	-talking -making something	-having fun -two way interaction	-teacher gives directions
Individual Child Pictures 4, 7	-playing -working alone	-children learning -teaching/learning	-working by herself -directed activity
Outdoor-Play Pictures 5, 8	-playing -playing on bars	-playing/sharing -self-taught	-physical -not teacher directed

children, the rating procedures were simplified. Therefore, pictures not assigned a rating of 10, 9, 1, or 2 for a given word were given a rating of 5.5. Stickers with the ratings of 10, 9, 1, and 2 were given to the respondents to place on the game board under their selected picture. The researcher read each word to the child and then assisted in where to place the sticker which had the number rating. Adults completed the task independently.

An example capsulizes these procedures. When the word fun was considered, the children playing on the jungle gym (Figure 1, picture 8) was assigned a 10, children playing with blocks, a 9 (Figure 1, picture 6). Walking in line with the teacher and writing A's were often assigned the lower 1 and 2 ratings (Figure 3).

Treatment of the Data

Two general types of analyses were used to uncover patterns in the beliefs which kindergarten children, their parents, and their teachers had about classroom learning occurrences. The personal construct elicitation task required respondents to sort pictures into mutually exclusive similarity groups. This grouping procedure resulted in a frequency of co-occurrences matrix for each respondent. When the respondents rated the supplied personal constructs and the scenes from classroom learning occurrences, a rectangular similarity matrix was formed. Kendall's tau was used in considering the stability of the rankings of the second set of classroom learning scenes. The typology of personal constructs facilitated the interpretation of the multidimensional scaling solutions.

The personal construct elicitation task required respondents to sort pictures into mutually exclusive similarity groups which generated a frequency of co-occurrences square matrix for each respondent. These individual respondent matrices were then aggreated into group matrices.

The group matrices included: separate matrices for the October and February interview data for the Jones teachers; a group matrix for both the October and February interview for the Jones children; group matrices for minority and non-minority children; and a separate matrix for Northside and the Smith kindergarten children. The rectangular similarity matrices formed from the rating task were aggregated into Jones parent, teacher, and children matrices, and an all children matrix.

Several considerations were made regarding the selection of the multidimensional scaling models used in the analyses: parsimony, interpretability, and the configuration of the stimuli. The Individual Differences Scaling model (INDSCAL) (Carroll & Chang, 1972) available in the Alternating Least Scales (ALSCAL) (Young, Takane, & Lewyckyj, 1978) program, permits the input of more than two square matrices, thus allowing a comparison among several matrices (Davison, 1983; Kruskal & Wish, 1978). Another feature of the INDSCAL model is that it provides a group space or configuration which indicates the overall structure for all of the matrices included in the analysis and then provides individual saliences on each dimension for each group matrix . This group-individual approach shows the relative importance of the dimensions of the group space to each individual within the group (Kruskal & Wish, 1978). INDSCAL, therefore, offered a way to compare the various groups of respondents included in this study. The EUCLID model also available in the ALSCAL program was selected to derive a multidimensional scaling solution for the rectangular similarity rating matrix. EUCLID allows the input of a rectangular matix of ordinal data and provides a multidimensional scaling solution for the matrix. The INDSCAL and the EUCLID models not only provided the means to analyze the two

types of data matrices, but also permitted a comparison between two different multidimesnional scaling solutions.

The preference rank order pictures were ordered by the participants according to their preferences for classroom learning activities, and the consistency between these rank orderings was evaluated by Kendall's tau. Kendall's tau represents the tendency of judges to agree in the ordering of a pair, and tau depends on the number of inversions in the order for a pair of individual rankings (Hays, 1981). A tau of 1.00 would indicate complete agreement; whereas, a tau of zero would indicate no agreement between the ranks; thus, tau is viewed as the index of correlation between the rank. The interpretation of this index of correlation, or tau, is the probability that the two objects show the same relative order in both rankings. The probability estimate provided by tau allows us to make bets on the way in which subjects will rank order data. This straightforward interpretation of Kendall's tau is an advantage in interpreting the values obtained for the comparison of the various rankings of the subjects.

Study Results

The results of this study are presented in three major sections -- INDSCAL, EUCLID, and Kendall's tau analyses -- with an accompanying editorial sidebar for each of these sections. The data are presented in this format so that the viability of each analyses in understanding the belief patterns which parents, kindergarten children, and teachers have about classroom learning events can be assessed. The research addresses three primary issues:

> The comparison of the beliefs about school learning among kindergarten children, their parents, and their teachers.

The comparison of beliefs among lower and middle income groups and minority and non-minority students.

The influence of the classroom learning environment on changes in the beliefs which kindergarten children have about school learning.

Each analysis addresses these questions. INDSCAL provides a means to address these questions by comparing the child, parent, and teacher groups to derive an overall group configuration, and to obtain saliences for each of the dimenions for the groups under scrutiny. The EUCLID analysis is an attempt to assess the way in which these adult and child groups paired constructs about classroom learning events supplied by the researcher with pictorial scenes about classroom learning events. Kendall's tau provides a probability index of the rankings of pictures of classroom learning scenes between and among selected respondents.

INDSCAL Analyses

INDSCAL typically provides one group space and the individual salience weights indicate the way in which individuals differ in perceptions of each of the derived dimensions. One assumption of this approach is that individuals share a common perceptual space. When this assumption is not the case, then solutions may poorly represent one or more of the groups or individuals (Day, Deutsch, & Ryans, 1978; Kessler, 1978). One solution is to perform separate INDSCAL analyses for the groups under consideration (Schmelkin, 1979). A variation of this approach was used in the present study, as the pilot study data suggested sharp distinctions between the teacher, parent, and children groups. It was also speculated that differences in ethnic and economic groups would yield very different perceptual spaces. In addition, the research questions addressed differences among groups; therefore, in this study INDSCAL proved useful in treating the groups of

children and adults as individuals might ordinarily be treated in the INDSCAL program. The salience weights of the individual groups were then compared to the group space.

The respondents -- the kindergarten children, the parents, and the teachers -- sorted the pictures into similarity groups which resulted in individual frequency of co-occurrence matrices. These individual matrices, which were aggregated into group matrices, permit comparisons among the following groups:

All Children: Smith, Northside, Jones students.

Jones Children: October and February interview

Ethnic Group-Children: Minority and Non-minority students

Jones Parents, Teachers, and Children: October interview

Jones Teachers and Children: October interview

Jones Teachers and Children: February interview

A two dimensional solution was found for each of the INDSCAL analyses as the number pictures used as stimuli in this sorting task was less ten. As Kruskal & Wish (1978) caution, empirical evidence justifies following the rule of thumb for determining the dimensionality: (number of stimuli - 1) = 4 (number of dimensions). Imposing this parameter to this study ensured the stability of the solution.

Findings are consistent for each of the INDSCAL analyses. The configurations of the picture stimuli on the two dimensional solution for each of the INDSCAL analyses vary little. The constancy of the spatial configuration creates a multidimensional scaling solution which is virtually the same for each of the participant group comparisons. Although the derived solution cannot be considered isomporhic, the similarities among the configurations lend themselves to a comparison of the adult/child and

child/child comparions. For each of the INDSCAL analyses, group comparisons yield substantial differences in the salience weights for each group. Both of these findings have some importance since the axes are not arbitrary in the INDSCAL analysis. Since the stretching and shrinking is only permitted along the coordinate axes, the coordinate axes play a special role which other directions do not (Kruskal & wish, 1978). This does not mean that the unrotated axes of the INDSCAL solution will necessarily have meaning, but typically the coordinates are directly interpretable (Wish & Carrol, 1974).

These underlying principles of INDSCAL suggest that it is feasible to compare the several derived INDSCAL solutions in this study. A discussion of the dimensions and the placement of the stimuli on these dimensions provides the preliminary information necessary to understand the way in which the various groups compared the pictures of classroom learning events. Interpretation of the dimensions is, of course, subjective but several parameters are used in the interpretation of the dimensions in this study. These parameters include the typology of personal construct data, the positive and negative dimension weights (Schmelkin, 1982), and the configuration of the picture stimuli in multidimensional space (Kruskal & Wish, 1978).

The INDSCAL solution was interpreted through the proportion of variance, the derived dimensions, and the salience weights. To provide some unity to the discussion, the variance values tabulated in Table 1 are described. Since two dimensions were obtained for each INDSCAL solution, a section is allocated to discuss each dimension. Each of these sections follows the same format: the configuration for the dimension and the salience weights is graphically depicted with an accompanying discussion. A

commentary follows which offers an interpretation of the results. A summary section detailing the overall findings for the INDSCAL solutions is then presented.

Proportion of Variance. The proportion of variance is the information which is explained by the derived INDSCAL solution. As a proportion, the closer the variance score approaches one, the greater the amount of information accounted for by the INDSCAL solution. Parameters to interpret proportion of variance values are based on the problem under scrutiny, but generally, variance values of .80 or greater are considered to explain much of the information (Hays, 1981). In most cases the porportion of variance for the derived INDSCAL solution in this study are at the .80 levle or greater (Table 2). the only substantial differences are in the All Children solution which accounts for .61, .66, .74 of the variance for the Smith, Northside, and JOnes children respectively. On first glance, it could be hypothesized that there is a lack of internal consistency among developmentally young children; however, higher variance scores were obtained for the Ethnic and Jones Children INDSCAL analyses. Another speculation is that the pictorial stimuli had more meaning for the Jones children as the pictures were derivatives of their setting. Again, however, the Ethnic Group INDSCAL analysis had higher variances and all children were included in this analysis. The difference may lie in the economic groups represented by each of the schools. Fairly substantial differences in the salience weights were found for the upper and lower income groups. This lack of consistency could be the result of economic group differences. A more careful appraisal of the derived INDSCAL dimensions provides further information about this phenomenon.

Table 2

Proportion of Variance Values for INDSCAL Analyses

Children Group Comparisons

All Children		Jones Children		Ethnic Group	
Smith	.61	October	.95	Non-minority	.77
Northside	.66	February	.86	Minority	.82
Jones	.75				

Adult-Children Group Comparisons

Jones Parents-Teachers-Children		October Jones Teachers-Children		February Jones Teacher-Children	
Parents	.95	Teacher	.81	Teachers	.91
Children	.72	Children	.94	Children	.79
Teachers	.87				

Table 3

Dimension Weights-Child Group Comparisons

	ALL CHILDREN		JONES CHILDREN		ETHNIC GROUP	
	I	II	I	II	I	II
1	-0.23	-1.67	-0.68	-1.22	0.74	-1.33
2	0.91	0.47	0.71	1.35	-0.86	-0.24
3	-1.52	0.45	-1.13	-0.68	0.93	1.26
4	0.99	-0.64	1.15	-0.11	-0.74	-0.91
5	-1.43	0.52	-1.29	0.86	1.02	1.06
6	0.73	0.59	0.25	1.23	-0.77	-0.38
7	1.29	-0.27	1.31	-0.56	-1.04	-0.72
8	-0.67	1.26	-0.82	1.07	0.33	1.43
9	-1.47	-1.02	-0.79	-1.48	1.67	-1.06
10	1.41	0.31	1.29	-0.49	-1.28	0.89

Dimension Weights-Child-Adult Comparison Groups

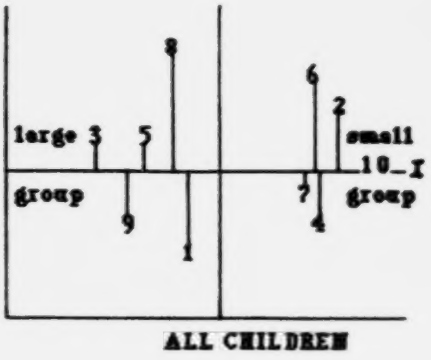
	JONES PARENTS-TEACHERS-CHILDREN		OCT JONES TEACHER-CHILDREN		FEB JONES TEACHER-CHILDREN	
	I	II	I	II	I	II
1	1.32	0.88	-0.76	-1.06	-1.11	0.79
2	-0.93	-0.61	0.79	0.21	1.51	1.12
3	0.77	1.57	-1.96	-0.73	-0.78	0.08
4	-0.24	-1.01	0.82	0.19	0.16	0.47
5	-1.08	0.69	-0.65	0.89	-0.54	-1.32
6	-1.29	-0.48	0.61	1.71	0.06	-0.43
7	0.82	-1.36	1.21	-0.52	0.91	0.34
8	-1.21	0.56	-0.61	1.21	-1.16	-1.14
9	1.32	0.98	-0.59	-1.67	-0.72	2.11
10	0.67	-1.22	1.13	-0.22	1.71	0.21

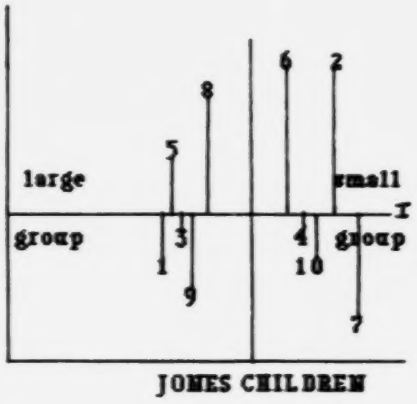
Dimension 1. The first dimension, designated as *participant configuration*, depicts groups of children and adults engaged in learning activities, with the distinction being between group size. Large group scenes are teacher-directed group activities or outdoor scenes. Small group activities are either child dyads or individual child scenes. The typology of personal constructs and the sample of classroom photographs facilitated the interpretation of this dimension. Dimension weights for each of the INDSCAL analyses are found in Table 3, and all pictures described in this section are included in Figure 1.

Dimension 1 for All INDSCAL Analyses

Children

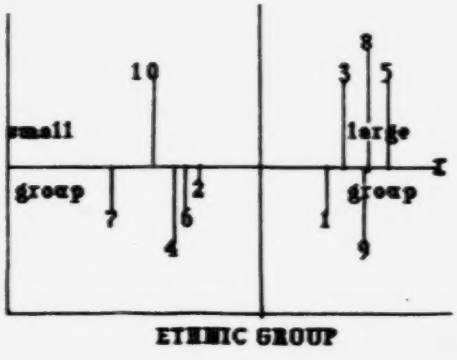
Dimension 1, *participant configuration*, was distinguished by small and large groups pictorial scenes. The small group scenes were child dyads (pictures 2, 6) and individual children (pictures 4, 7, 10). The large group scenes were teacher directed (pictures 1, 3, 9) or outdoor (picture 5, 8). In the analyses of the Jones and All Children groups, the scenes on the small group pole received positive dimension weights, and those on the large group pole negative weights. The Ethnic Group analysis was counter to this pattern: the large group scenes had positive dimension weights and the small group scenes had negative dimension weights.



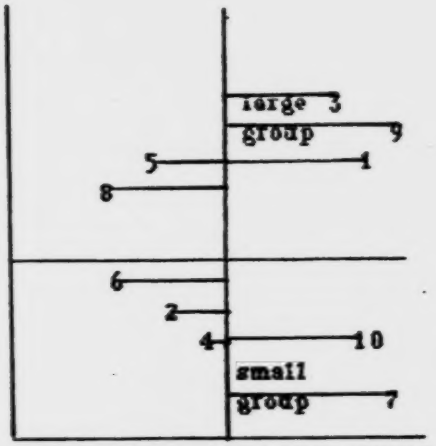


Adults with Children

Dimension 1 remained *participant configuration* when the Jones Teacher-Children groups were considered for October and February. However, when Jones Parent, Teacher, and Childen were considered, the participant configuration scenes configured on dimension 2. Since, the scenes fell on the same poles, it seemed plausible,



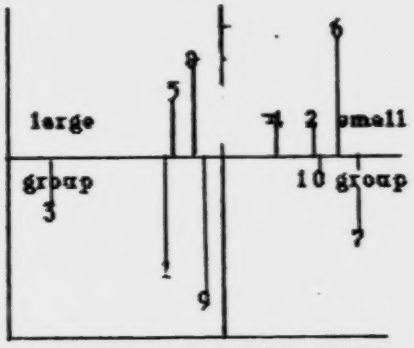
in this case, to consider dimension 2 in this section. The *participant configuration* dimension had two poles: small group--child dyads (pictures 2, 6) and individual child scenes (pictures 4, 7, 10), and large group--teacher directed (pictures 1, 3, 9) and outdoor (pictures 5, 8). In both October and February, the Jones Teachers and Children analyses had positive dimension weights for small group scenes, while negative dimension weights were found for the large group scenes. The Parents-Teacher-Children analysis, however, revealed negative dimension weights for small group scenes but positive weights for the large group scenes.



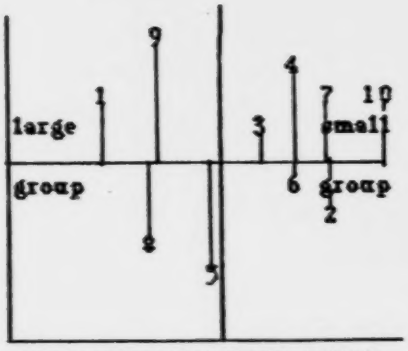
JONES PARENT-TEACHER-CHILD

Commentary

One might conjecture that children and teachers view learning as a more pleasurable task when children can participate in structured learning activities individually or with another child. Parents may hold the view that the teaching-learning enterprise requires teacher-directed instruction to larger groups. The typology of personal constrcuts offers an alternative explanation for positive dimension weights assigned to the large group pictures by the Parent-Teacher-Child and Ethnic groups. Hispanic parents considered the children depicted in the individual child scenes as isolated, lonely, and shy. It may be that larger groups have more cultural saliency.



OCT JONES TEACHER-CHILD



FEB JONES TEACHER-CHILD

The grouping of the outdoor scenes (pictures 5, 8) and the negative weights for these pictures assigned by the children group and teacher-children group analyses and the positive weights assigned in the parent-teacher-child analysis seemed counterintuitive. Again, the typology of personal constructs provided some explanation.

Parents seemed to dichotomize kindergarten activities into work and play activities. Work activities were those which occurred inside the classroom and were both structured and directed by the teacher. Play activities were those which occurred outdoor and were necessary to give children respite from school structure. Parents also viewed small group activities as fun and not necessarily learning. Neither children nor their teachers were as dogmatic in their notions of work and play.

The typology was also helpful in interpreting the position of the outdoor scene which showed three children talking (picture 5). This scene was configured with the large group pictorial scenes, which at first glance seems incorrect. Children assigned negative weights to this picture, and they described it as "too dark", "scary", or "boring". Parents and teachers spontaneously remarked, on seeing this picture, that they like it because the children were "free", "easygoing", or "enjoying each other." It may well be in this instance that that neither the adults nor the children were attending to participant configuration, but rather grouped this with other preferred or non-preferred scenes. The *participant configuration* scenes indicate that group size has relevancy for all the participants, and the dimension weights suggest parents differ from teachers and children in their preferences for group size.

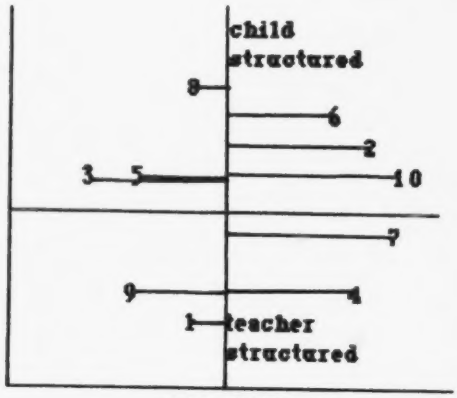
Dimension 2. The second dimension which emerged in the INDSCAL solution was *learning activities*. What differentiated the poles of the configuration was structure: pictures converged on either the child-

structured or teacher-structured poles. Child-structured activities were those which may have been prepared in advance by the teacher but which children themselves directed and interpreted. Teacher-structured activities were those which were typically directed by the teacher, or, although directed by children, may have allowed little individual interpretation. Although there were some variations in the picture configurations for the various groups, typically the child-structured scenes were pictures 2, 5, 6, and 8 andand 8. the teacher-structured scenes expanded to 1, 3, 4, 7, 9, and 10.

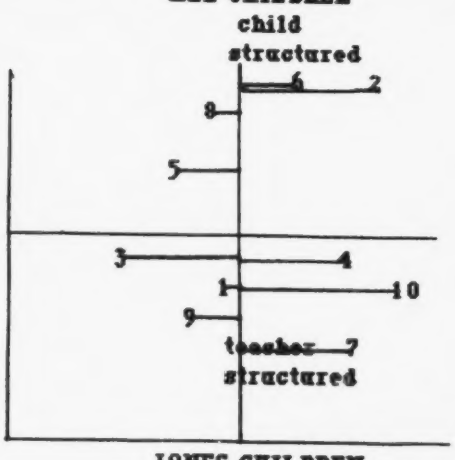
Dimension 2 Learning Activity

Children

In the All Children analysis the continuum of teacher to child-structured scenes were 1 and 9 as teacher-structured and 2, 6, 8 were child-structured. Pictures 4 and 7 fell closer on the teacher-structured end of the continuum. Allying more closely with the child-structured activities were pictures 3, 5, and 10. The Jones-Children, in the October-February analysis considered pictures 2, 6, 8 as child-structured, and pictures 1, 7, and 9 which fell on the opposite pole were teacher-structured. Pictures 4, 7, 3, and 10 also fell on the teacher-structured pole and picture 8 was spatially aligned with the child-structured activities. The configuration for the Ethnic Group analysis showed pictures 1, 4, and 9 as anchoring the teacher-structured pole with the child-structured activities 3, 5, and 8 falling on the other continuum. Picture 10 configures with the chid-structures scenes; whereas, pictures 2, 6, and 7 are more closely aligned with the teacher-structured pole.



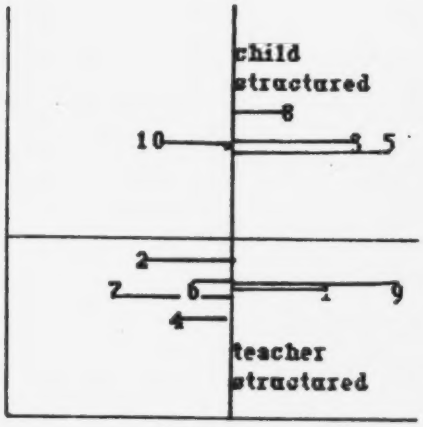
ALL CHILDREN



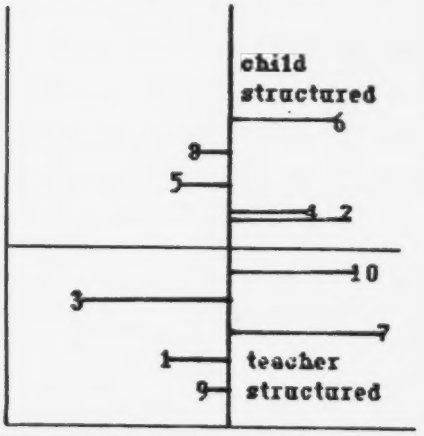
JONES CHILDREN

Adults with Children

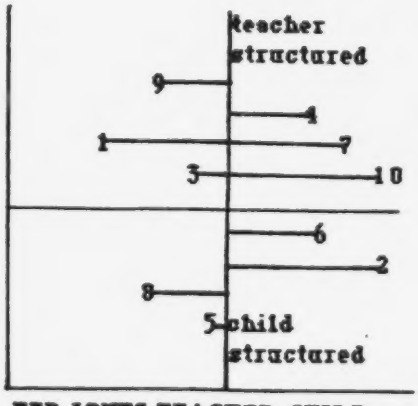
The adults with children analyses configured both child and teacher-structured activities on the *learning activities* dimension. The spatial arrangement for the three Jones-Parent-Teacher-Child and the October Jones Teacher-Child analyses were the same: the teacher-structured pole featured scenes 1, 3, 7, 9, 10, and the child-structured scenes were 2, 4, 5, 6, and 8. However, positive dimension weights were assigned in the Teacher-Children analysis and negative weights were assigned in the Parent-Teacher-Child analysis. This pattern reversed itself in the February Jones Teacher-Children analysis. Positive dimension weights were given to teacher-structrured activities and negative weights were assigned to child-structured activities. In addition, the configuration in the INDSCAL analysis for the February analysis showed slight spatial variations. The child-structured activities were limited to scenes 2, 5, 6, and 8. the teacher-structured scenes expanded to 1, 3, 4, 7, 9, and 10.



ETHNIC GROUP



OCTOBER JONES TEACHER-CHILD

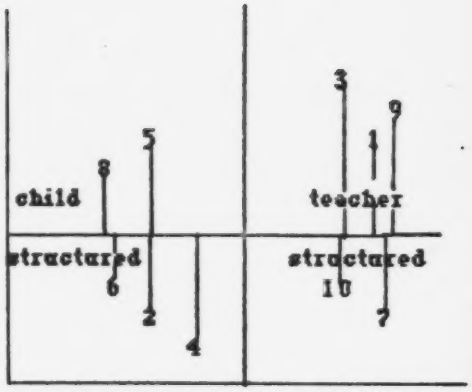


FEB JONES TEACHER-CHILD

Commentary

A casual inspection of the spatial configuration for each of the INDSCAL analyses suggests that the polar dichotomy is work and play. The typology of personal constructs suggests otherwise. Several children described the picture of the individual child writing (picture 7) as play, and some children who did not like climbing activities stated that the playscape scene (picture 8) was "work". A more careful perusual of the interview data indicated that children described some activities as being externally governed by rules and others which they could interpret. For example, "You have to write A's" and "You raise your hand if you know the answer" (pictures 7 and 9) are circumscribed

activities; whereas, "We can build something on our own" (picture 6) permits child input into the structure of the activity. The differences for this dimension seemed to be whether the activity was teacher or child-structured.



JONES PARENT-TEACHER-CHILD

The differences between the October and February Teacher-Child analyses in both the spatial configurations and the dimension weights suggests an enculturation pattern. The child-structured activities had positive dimension weights in October but negative weights in February; however, in February the teacher-structured activities were expanded to include individual child activites. It may well be that by the second semester both teachers and children viewed teacher-structured activities more positively and expanded this category to include tasks which individual children pursued by themselves.

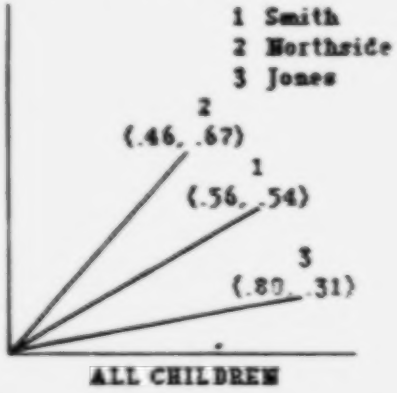
In both the All Children and Ethnic Group analyses, picture 3, the teacher directing children in line, fell with child-structured scenes. Although adults described this scene as "necessary school structure", children frequently saw this as the necessary precedent to play outdoors. Thus, it seems likely that children who viewed this picture as "going out to play" would assign it to child-structured activities.

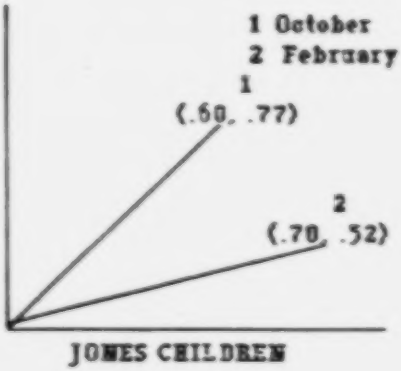
Saliency for the Dimensions. Separate INDSCAL analyses were performed for child and child-adult comparisons. Three INDSCAL analyses were performed for child groups -- Jones Children, All Children, and Ethnic Groups, and separate INDSCAL analyses were performed for Jones Parents, Teachers, and Children, and Jones Teacher and Children in both October and

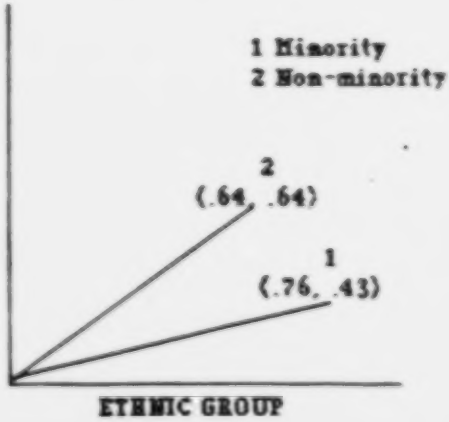
February. When considering any of the group comparisons, whether adult-child or child, substantial differences in the saliences for each group are found. These differences in saliences or dimension weights indicate the relative importance of the derived multidimensional scaling solution dimensions. As suggested previously in this paper, these saliences provide not only a means to compare the groups included in each analysis, but since the dimensionality is so similar for each of the groups, inferences between INDSCAL analyses may be postulated.

Child Group Comparions

The All Children analyses show different salience weights among the three groups compared. The children from Smith school, who are middle income Hispanic and Anglo students, had almost equal salience weights for the *participant configuration* and *learning activities* dimensions. Children in the upper middle income Northside school have lower dimension weights for *participant configuration* than *learning activities*. The lower income students from the Jones school had much higher salience weights on the *participant configuration* than on *learning activities* dimension. Comparisons among the three groups indicate that the Jones children have substantially higher saliencies for the *participant configuration* dimension and fairly low saliencies for the *learning activities* dimension. The saliency for dimension 1 for the Jones children is almost two times that of the Northside group, and conversely, the salience weights for the Northside group on dimension 2 is two times as great as that of the Jones children. The Smith group saliences

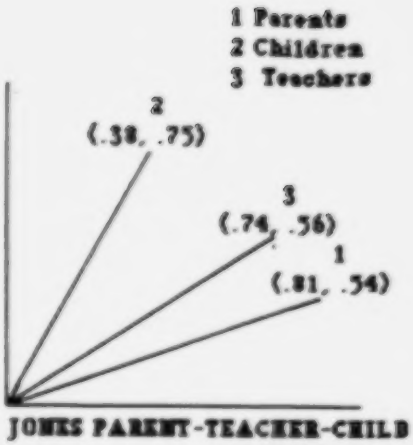




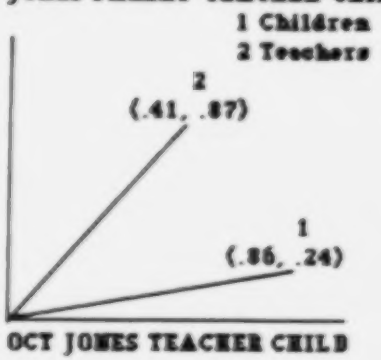


weights are closer to those of the Northside group on both dimensions.

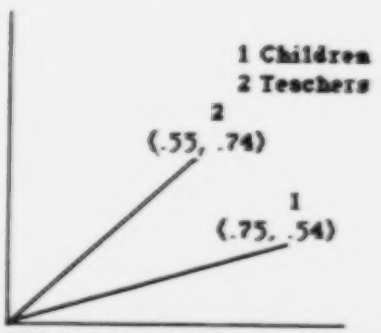
The non-minority children in the Ethnic group INDSCAL analysis have the same dimension weights for both the *participant configuration* and the *learning activities* dimensions; however, their minority counterparts have much higher dimension weights for the *participant configuration* dimension, and the saliency for dimension 2 is much lower than that of the non-minority children. The Jones Children analysis reveals lower dimension weights for the *participant configuration* dimension in October than in February. The opposite pattern is found for the Jones children's dimension weights on dimension 2. In October they had high saliencies for the *learning activities* whereas, in February these salience weights decreased substantially.



JONES PARENT-TEACHER-CHILD



OCT JONES TEACHER CHILD



FEB JONES TEACHER CHILDREN

Children-Adult Group Comparisons

Three INDSCAL analyses were performed which compare child and adult groups. The October interview of Jones Parents, Teachers, and Children and the comparison of Jones teachers and children in October and February indicated differences between adults and children in all cases. These differences are substanitally greater in October than in February. The Jones Parents, Teacher, Children INDSCAL analysis shows considerable similarity in the dimension weights for both *participant configuration* or *learning activities* dimensions when the adult groups are considered. Both parents and teachers have considerably higher saliencies for the *participant configuration* dimension, and the parents'

saliencies are higher on this dimension than the teachers. The dimension weights for the children were considerably different than the adults on both dimensions. Children have much lower dimension weights on the *participant configuration* than the *learning activities* dimension, and the saliencies for the children on the first dimension is two times greater than that for the second dimension.

The Jones children and teacher comparisons show much greater differences in October than in February. In October, the teachers had saliency weights on the *participant configuration* dimension which are almost four times greater than that of dimension two. In February the differences between the two dimensions differ much less for the teachers. The children's saliency weight is four times greater than that of the teachers' in October. This difference between the teachers and the children on the second dimension decreases markedly in February.

Commentary

A casual inspection of the graphic representations of the salience weights for the adult-child and child group comparions clearly indicates that adults and children differ on both the *participant configuration* and *learning activities* dimensions. The fact that the *learning activities* have considerably higher saliency for the children than for the adults suggest that choice in learning activities is important for children. A caution is in order, however. The Jones children represent lower income families. It may well be that the parents and the teachers in this group are

conveying the message that obtaining an education is critical ; therefore, learning in structured groups is more important than activities which children themselves direct. Further support for this speculation is given by the comparison among all the children. Jones children have much higher salience weights on the *participant configuration* dimension than their middle or upper middle income counterparts. The parents and teachers may convey that learning requires structure by the teacher. Upper and middle income families may support varigated learning activities in the classroom. This same phenomenon may occur with minority and non-minority children as the minority children saw the *participant configuration* dimension as the more salient of the two. More information from middle and upper middle income parents and teachers is required to support this claim.

EUCLID Analysis

The EUCLID model available in the ALSCAL program was used to assess the ratings which respondents gave to words which children had used to describe classroom learning scenes and the pictorial stimuli representing these classroom learning scenes. A degenerate solution was obtained. As noted in Figure 5, the number of stimulus points is small compared to the number of stimuli, and further evidence of degeneracy, is given by stress levels near zero and high proportion of variance values obtained for this solution (Davison, 1983; Shepherd, 1974).

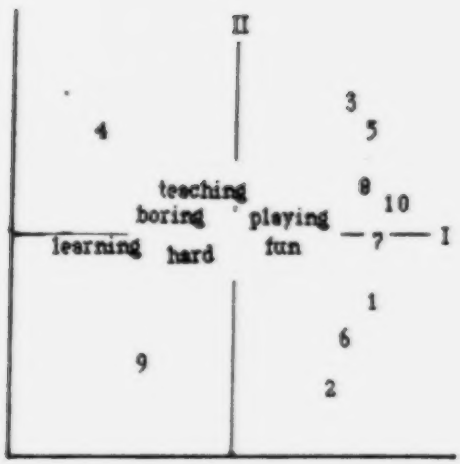
Other strategies exist to obtain an interpretable solution. One tactic is to increase the number of dimensions. The caveat regarding the number of stimuli required in relation to the number of dimensions cited previously

Figure 5

Euclidian Analysis of Ratings of Supplied Constructs and Pictures

Young's S-Stress Formula 2 = .08

Proportion of Variance = .99



applies in this case also. Another solution is to transpose the matrix, obtain difference values for the derived INDSCAL dimension weights, and regress these dimension weights on the MDS solution for the rating of the words and pictures. This tactic was not applied for two reasons. First, since the INDSCAL analyses were performed separately for each group, this linear regression procedure would have to be performed for each group separately. Unless constant difference dimension weights are used for each linear regression, it is difficult to compare the various solutions. Second, the degenerate solution may be a result of the rating procedures. As described above, respondents ranked the words and the pictures by assigning a ranking of 10 and 9 to those pictures most like the word and a 1 and 2 to the two pictures most unlike the word. The rest of the pictures were given a ranking of 5.5. The lack of gradient among the rankings for all pictures may have resulted in little variation in the preference rankings, thereby producing a degenerate solution. It was primarily for this reason that no other MDS solution were sought for the word-picture rating data.

Kendall's Tau

Children, parents, and adults rank-ordered the preference rank order set of pictorial stimuli according to their preferences for classroom learning activities. This preference rank-ordering was used to obtain more precise information regarding the types of participant configurations, subsettings, and activities which kindergarten children, parents, and teachers prefer. A subsample of the participants in this study was included in the analysis of the rank-ordered data. The Jones children are compared for their rank ordering of the picture stimuli in October and February; the children rankings in February and October are compared with the parent October ranking; and the teachers are compared for their October and February

rankings. Since applying Kendall's tau to rank-ordered data requires a comparion between two judges or the same judge at different times, the comparions in this particular instance are intra-subject for the teachers and children and inter-subject for each individual child and his or her parent.

Table 4 lists the obtained tau values for each of the analyses. Some patterns emerge when the tau values are examined. When considering the tau values for the children, four of the children are at the .50 level; thus, for these four children, the probability that similar rankings would be obtained for the October and February rankings is .50. These four children included an Hispanic and an Anglo boy and an Hispanic and an Anglo girl. Three of the children were considered average achievers by their teachers. The Anglo boy, however, had been recommended for evaluation for special education placement. The above average achieving children -- an Anglo girl, two Anglo boys, and an Hispanic boy had tau values at neglible or low levels indicating little or no predictability between the October and the February rankings. A possible explanation for this complete lack of predictability may be that children who achieve in school alter their beliefs or perceptions about learning events to conform to those of the classroom milieu. No predictable patterns are distinguished when the rankings of the children were compared to those of the parents; thus, it may be that parents do not exert a particularly strong influence on the preferences which their children have for classroom learning activities. The teachers had very different tau values from each other. The one teacher's tau value was two times as great as that of the other. The constancy of the one teacher's rank ordering may indicate a stability in the beliefs which she has about learning in school.

Table 4

Obtained Tau Values for Preference Rank Orders

Intra-Subject Comparisons for October and February Teacher Rankings

Teacher 1		Teacher 2	
.33		.66	
Above Average Achieving Children		**Average/Below Average Achieving Children**	
Inter-Subject October/February		Inter-Subject October/February	
G_1*	.05	B_5*	.50
B_2*	.05	G_6*	.50
B_3*	.33	B_7+	.50
B_4+	.16	G_8+	.55
Intra-Subject Child/Parent	Oct. Feb.	Intra-Subject Child/Parent	Oct. Feb.
G_1*	.22 .11	B_5*	.22 .11
B_2*	.27 .27	G_6*	.22 .16
B_3*	.22 .11	B_7+	.33 .61
B_4+	.16 .22	G_8+	.11 .11

B - Boy * Anglo Subscript denotes an individual subject
G - Girl + Hispanic

One problem with the procedures used to evaluate the preference rank ordering of the pictorial stimuli, is that the attributes of classroom learning events and the levels of these attributes are not evaluated. An inspection of the preference data indicates that children selected the child dyad or individual child pictures nine times as often as the teachers and twice as often as the parents. This may explain the lack of predictability between the parent and child rank orderings. The four achieving children have more variations in their preferences for classroom learning scenes. Although they were more likely to select individual and child dyad pictures as their most preferred, they also included teacher-directed activities as their most preferred. Certainly other analysis procedures of these preference rank-ordered data would provide more precise information regrading the attributes of classroom learning activities which adults and children prefer.

Discussion

The complexity of a classroom learning environment and the many factors which influence the interactions and participation during learning events require multi-operational approaches in the study of the classroom milieu (Cook & Campbell, 1982). Socio-cultural research , personal construct theory, and non-verbal choice behavior, as the theoretical framework which guided this research, indicate the need for an iterative process to tap the underlying complexity of the classroom learning environment and to accurately represent these events to classroom participants. This iterative process, used in both the methodological and analysis approaches, was instrumental in isolating the distinctive attributes of the classroom learning events and uncovering the beliefs of the divergent groups of children and adults.

Several things were learned through the iterations. The analysis of the teacher workplan, the set of 250 classroom learning events photographs, and observations in the classroom produced pictorial stimuli which proved effective in eliciting the personal constructs of the participants. The variety of interview tasks--sorting, descriptions, ratings, and rankings--offered varying levels of information regarding the participants' perceptions of classroom learning events. The multidimensional scaling solutions, typology of personal constructs, and Kendall's tau values provided a composite of the participant belief patterns.

Multidimensional scaling was a viable adjunct analysis to personal construct elicitation as the configuration of the pictorial stimuli in multidimensional space uncovered patterns in the beliefs of the participants. The evolution of the *participant configuration* and *learning activities* dimensions aligned the pictorial representations in space, and the typology of personal constructs provided a way to interpret the derived dimensions. The multidimensional scaling solution and the typology of personal constructs were interpreted through a dialectical process, in that, the derived MDS dimensions and the personal constructs had enhanced meaning when considered against each other. The assignation of the *learning activities* dimension was a result of this dialectic, for the dimension would have been incorrectly interpreted as the dichotomous relationship between work and play if the typology and dimensions were not evaluated jointly.

Differences in the preferences for types of classroom learning events between achieving and non-achieving children emphasize the need for more precision in the analysis procedures. Increasing and diversifying the pictorial array would uncover other complexities in belief patterns by allowing higher MDS dimensional solutions. Conjoint analysis, however, is an alternative

procedure. The conjoint analysis program Linear Programming Techniques for Multidimensional Analysis of Preferences Judgments (LINMAP) (Shocker & Srinivasan, 1978) performs analyses of ordinal preferences and provides a utility measure for each of the attributes considered in the rank ordering. Kendall's tau then provides a probability estimate for this utility value. As a measure of the joint effect of two or more independent variables on the ordering of an independent variable, such information would allow estimates of classroom learning events attributes (Green & Rao, 1975; Green & Wind, 1973).

In closing, the iterative process used in this study is analogous to a Bayesian approach in which prior information derived from theory and research is used to develop the research questions, methods and analyses to obtain more information about the problem under scrutiny (Hays, 1981). In this particular research effort, the Bayes analogue applies in approaching the classroom setting from several vantage points on different occasions to develop the instruments; by tapping the participant beliefs through multiple interview tasks, and by uncovering belief patterns through several analysis procedures. Multidimensional scaling methods offer a way to learn more about the aspects of the classroom environment which have saliency for the participants, and are effective as an adjunct to the personal construct elicitation procedures. This research suggests that neither the personal construct typology nor the derived multidimensional solution of themselves are sufficient to understand the belief patterns of the participants. The findings from this research indicate that, when paired, multidimensional scaling and personal construct elicitation tap belief systems. Finally, this

research gives empirical support for the continued use of multi-operational approaches to study individuals interacting and participating in a social environment.

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differences options. Journal of Marketing Research, 15, 612-615.

Acknowledgments

The artists renderings for the pictorial stimuli in this study are by Randy Mott, Austin, Texas.